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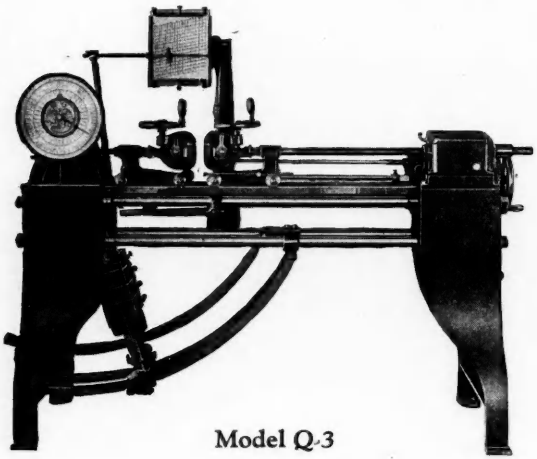

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TESTERS

The Editor's Page

Test Methods for Evaluating Textile Finishes

TWO RESEARCHES that have for their objective the development of scientific test methods for evaluating textile finishes, and that will supplant the empirical methods now generally used, are being organized by special committees of the American Association of Textile Chemists and Colorists and Committee D–13 (textiles) of the American Society for Testing Materials. The marked increase in the number of new textile finishes during recent years has been so rapid that, while many new instruments and techniques have been developed for their evaluation, few if any have gained official or general acceptance. Basic to their development is the establishment of definitions of, or standards for, so-called permanence of finish.

The A. A. T. C. C. has provided a grant for a Fellowship to conduct its research on this subject at Massachusetts Institute of Technology, and work has already been started under the direction of a committee consisting of Kenneth H. Barnard, Prof. Louis A. Olney and Prof. E. R. Schwarz. A steering committee of D–13, A. S. T. M., was appointed in May, 1938, to organize and secure subscriptions for a research on this subject, the committee being headed by L. B. Arnold, Jr., with E. A. Georgi as secretary. As of Jan. 20 nine subscribers had been secured, and a meeting was held at the Chemists' Club, New York City, Jan. 26, to complete arrangements for the research.

The objectives of both researches being practically identical, it seems both logical and probable that those in charge of their organization and direction will recognize the wisdom and advantages of combining their resources and abilities.

Personal

Harry L. Hopkins, recently appointed Secretary of Commerce succeeding Daniel C. Roper, becomes automatically a director of The Textile Foundation in accordance with the provisions of the Act of Congress under which the Foundation operates.

* * *

Dr. Henry Dreyfus, co-founder and chairman of British Celanese, Ltd., and a director of Celanese Corp. of America, has been awarded the Perkin Medal of the Society of Dyers and Colourists of Great Britain, the presentation having taken place Jan. 19, at Bradford, Eng. The award was for "Discoveries and work of outstanding importance in connection with the development of the cellulose acetate rayon industry in England."

* * *

Herbert A. Kaufmann, who has been associated with Stein, Hall & Company, Inc., for the past twelve years, has resigned to join the production staff of the American Maize-Products Company. Mr. Kaufmann, whose work has previously been primarily in the field of developing technical uses for dextrines and starches, will be engaged by the American Maize-Products organization in the production of such materials.

Giles E. Hopkins has submitted his resignation, effective April 1, 1939, as Technical Director of the Bigelow-Sanford Carpet Company, Inc., to accept a position with the United Shoe Machinery Corporation. Mr. Hopkins came with the Bigelow-Hartford Carpet Company, Inc., as Chemical Engineer in January, 1929, and was appointed Technical Director of the Bigelow-Sanford Carpet Company in April, 1931. He was active in the affairs of the American Society for Testing Materials, the Industrial Research Institute associated with the National Research Council, and the United States Institute for Textile Research. He served on the Executive Committees of the A. S. T. M. and the I. R. I., and was a Director of the U. S. I. T. R.

* * *

Science and Empiricism

CELLULOSE ACETATE filaments having tensile strength double that of natural silk and as fine as one-tenth denier, were revealed as the newest product of that company by Dr. Dreyfus of British Celanese, Ltd., in his address following receipt of the Perkin Medal, Jan. 19.

* * *

THE "CRIES" of textile fibres when torn may be used for their identification if the interesting acoustical experiments, demonstrated recently by a Prof. Jovanovits before the International Congress of Color Chemists, can be applied successfully. The "cries" of torn fibres when amplified showed a marked difference between those of wool and cotton, between high and low grade flax, and between filament viscose rayon and viscose staple fibre. By use of optical and electronic devices the sounds may be recorded.

* * *

"HORSEHAIR" was one of the first commercial products of the viscose rayon process. Its production is reported to have been revived in England by Courtaulds, Ltd., in staple fibre form for use as a filling material for mattresses, etc. There can be no question as to the hygienic properties of the fibre but demand for it will still depend somewhat upon its price as compared with natural filling materials.

* * *

RESEARCH expenditures by United States industry and agriculture annually, in round figures, are about one cent for each dollar grossed. Industry spent about 1.7% (some $250,000,000) out of $14,790,000,000 income of 1936. Agricultural research, almost wholly by state and federal institutions, was 0.37% or some $35,600,000 of the estimated $9,530,000,000 cash farm income and value of home-consumed farm products combined. In terms of population, the total for research expenditures in these two great fields is only $2.00 per person.—Data from "Expenditures for Agriculture and Industry Research Compared." Office of Experiment Stations, U. S. Department of Agriculture.

* * *

TEXTILE Foundation's research program at the National Bureau of Standards is to obtain basic data on the chemical and physical-chemical properties of textile fibres. According to Dr. Milton Harris, director

(*Continued on page 145.*)

A Study of Time and Accuracy in Testing Textiles

By J. EDWARD GILL *

Introduction

THERE is considerable discussion throughout the textile industry concerning the relative merits of the "grab" and "strip" methods for textile testing. Quite often it is necessary to obtain test results on which to base the performance of a textile material, and at other times the test results are used only for control of quality or uniformity of a lot or shipment of fabric. Which of the methods is most adaptable to the conditions cited above? Another question which might be raised concerns the changing of values obtained by one method into the equivalent values of the other method as a matter of expediency.

This promotes further consideration of effect of time on results and logically enough these questions are raised: Is the additional time required for accomplishing the "strip" method worthwhile? Does the experience of the operator reflect in the results obtained, or in the time required to accomplish the tests?

The data presented in this paper were obtained in a study of some of the above questions in their application to testing cotton airplane cloth. Since the principles for testing other fabrics are the same, the results of these tests are of interest in the general field of textile testing.

Materials and Methods

The fabric used in this investigation was standard Grade A Airplane cloth conforming to U. S. Specifications 6–97–E, and this specification requires a fibre length of at least 1½ inches, a thread count of 80–84 ends in the warp and filling, tensile strength of not less than 80 pounds per inch in warp and filling when tested by the "strip" method. A maximum weight of 4.0 ounces per square yard is allowed. The material is a plain weave. It is processed in an unbleached, mercerized, and calendered finish. All specimens were taken from the same cut. Both "grab" and "strip" methods were accomplished in accordance with Federal Specification CCC–D–191a, Textile Tests Methods, which is in agreement with the procedure recommended by the American Society for Testing Materials.

The specimens were prepared from ½-yard samples which were taken from the same cut (120 yds.) of fabric. This procedure was followed in order that the tensile tests be comparative to standard laboratory practices. No effort was made on the part of either of the operators to speed

* Junior Textile Technologist, U. S. Army Air Corps, Wright Field, Dayton, Ohio.

up the preparation of specimens. A record was kept of the actual time required to prepare the specimens as is done in usual laboratory practice in accordance with Federal Specification CCC–D–191a.

Operators

The results of three operators were compared, and this number was selected to represent personnel having varied experiences in textile testing. Operator A had the most recent training and experience of the three. Operator B had the least experience of the three. Operator C had the most experience, but had been away from actual laboratory testing longer than operators A and B.

Results of Tests

A comparison of the time required by two operators to prepare the specimens is shown in the following table:

TABLE I

Preparation of Specimen (Time Study)

	"GRAB" METHOD			"STRIP" METHOD		
Operator	No. Spec.	Time Req'd Min.	Ave. Min. Spec.	No. Spec.	Time Req'd Min.	Ave. Min. Spec.
A	78	61	0.781	60	84	1.400
B	94	85	0.904	114	159	1.395
Totals	172	146		174	243	
Av. of Oper.			0.842			1.397

The tensile tests were accomplished in a standard atmosphere of 65% R.H. at 70° F. Two series of tests were accomplished. In one series, time was a factor and every effort was made to speed the testing, little attention being given to the placing of the specimens squarely in the jaws of the tester. The other series of tests were accomplished in a manner such that extra care was exercised in placing the specimens squarely in the jaws of the tester to insure that the same series of threads was caught by both upper and lower jaws. No record was kept of the time required to accomplish this series of tests.

A comparison between the time required by three operators to accomplish the testing of the specimen using the "grab" and "strip" methods is shown in the following table.

When the data presented in Tables I and II are compared, it is seen that the time required to test the specimen by the "grab" and "strip" methods is practically the same, but that it requires more time to prepare the "strip" specimen. This is due to cutting the specimen and pulling excess threads from the sides to obtain exactly one inch of woven material. The "grab" specimens are prepared by using a 4×6 inch pattern and cutting the specimen to this size without taking time to pull away threads to obtain an exact dimension. The data also show that it requires an average of 1.199 minutes per specimen to prepare and test the "grab" specimen, while the same operations for the "strip" method

TABLE II

Testing of Specimen (Time Study)

Operator	"GRAB" Spec. Tested	"GRAB" Time Req'd Min.	"GRAB" Ave. Min. Spec.	"STRIP" Spec. Tested	"STRIP" Time Req'd Min.	"STRIP" Ave. Min. Spec.
A	56	13	0.232	58	17	0.293
B	58	28	0.482	58	24	0.413
C	58	18.5	0.319	58	21	0.362
Totals	172	59.5		174	62	
Av. of Oper.			0.344			0.356

required 1.75 minutes per specimen; in other words, it required 46% longer to prepare and test the "strip" than the "grab" specimen.

Comparison of Results

The value of time is recognized in textile testing laboratories as well as in other branches of the industry, and every effort may well be taken to save time in testing so long as the results are consistent and give accurate data on which to calculate the performance of the materials being tested.

The average tensile results obtained by three operators when accomplishing tests using the "grab" and "strip" methods for time and accuracy are shown in Table III.

TABLE III

Operators	Time Study "Grab" Tensile (lbs.) Warp	Time Study "Grab" Tensile (lbs.) Fill.	Time Study "Strip" Tensile (lbs. in.) Warp	Time Study "Strip" Tensile (lbs. in.) Fill.	Accuracy Study "Grab" Tensile (lbs.) Warp	Accuracy Study "Grab" Tensile (lbs.) Fill.	Accuracy Study "Strip" Tensile (lbs. in.) Warp	Accuracy Study "Strip" Tensile (lbs. in.) Fill.
A	87	96	83	94.2	91.8	102.2	84.1	94.9
B	92	97	85	97.0	90.2	94.8	85.1	96.4
C	93	105	87.2	98.8	91.8	98.5	85.9	98.2
Av. of Oper.	90.6	99.3	85	96.6	91.3	98.5	85.0	96.5
% Diff. "Grab" over "Strip":	plus 7%–plus 3%;				plus 7%–plus 2%.			

Tensile values obtained when testing by the "strip" method approximated the same average whether the time or accuracy study was being accomplished. This was due to the size of the specimen which determined that the fabric assistance due to the woven material was constant, and that the same series of threads were gripped by the upper and lower jaws of the tester.

Experience throughout the industry has shown that there are factors by which one can convert "grab" tensile results into the equivalent "strip" values for a given fabric. Previous results showed that on airplane fabric the warp "grab" results were 17% higher than "strip" values, while the filling "grab" results were 15% higher than the "strip" values.

The data presented in Table III do not agree with the values of the

previous investigations, but they do support the results in that the warp "grab" results are higher than the comparative filling "grab" results. By comparing the results of past and present investigations, it is seen that a relationship does exist between "grab" and "strip" results; however, the factor to convert the values of one method into the equivalent values of the other must be determined on each lot of fabric, whether it is airplane fabric or dress goods. The data presented in Table III support this fact, and this is logical for there are many variables which will naturally exist in different lots or shipments of material of the same quality and finish. Some of the variables which have an effect on tensile results are yarn tension of both warp and filling, fibre length of both warp and filling, twist variations in the yarn, natural and artificial size (fats, waxes, or starches) and yarn crimp.

The erratic results obtained by the "grab" method are not sufficient in themselves to condemn the method, because it is affected by the variables mentioned, fabric assistance probably being the greatest; therefore, it is a means of measuring the fabric failure as a unit. Results obtained by the method however are often of doubtful use, because operators of varying experience obtain different values when testing the same piece of material. The "grab" method probably requires the most skill in testing because of the difficulty in clamping the same series of threads between the upper and lower jaws and duplicating the procedure for all tests.

Individual results obtained from the time and accuracy test, when studied, show that the "grab" results are "spread" over a wider range, while the "strip" results are more consistent and the values obtained do not cover such a wide range.

Finally, it is well to consider the "spread" of individual results obtained by each operator when accomplishing the time and accuracy study of each method, and these data are shown in Table IV.

TABLE IV

Strip Method. Tensile (lbs./in.)

	Time		Accuracy	
Operator	Range Warp	Range Filling	Range Warp	Range Filling
A	79–90	84–100	79–88	92–100
B	80–90	89–109	82–90	89–102
C	79–96	93–107	83–93	88–110

Grab Method. Tensile (lbs.)

	Time		Accuracy	
Operator	Range Warp	Range Filling	Range Warp	Range Filling
A	83–95	86–119	82–103	92–120
B	75–98	80–112	80–95	86–102
C	80–102	95–120	80–103	90–111

The general trend is for the results to fall within narrower limits when tests are conducted for greatest accuracy by either the "grab" or "strip" methods. This performance is expected and testing laboratories should take this factor into consideration on all tensile test.

Summary

The more experienced operator prepares and tests specimens faster than the inexperienced operator, and textile testing laboratories may well consider this in establishing a criterion for the speed of their personnel.

Experience reflects in the results obtained, because it is seen in Table IV that the general trend of results of the most experienced operator is in more narrow limits than the results of personnel of less experience.

Most consistent results are obtained when a reasonable amount of care is exercised in placing the specimen squarely in the jaws of the tester.

More time is required to prepare and test "strip" specimens, but the results are more consistent. In view of this fact, the importance of both methods of test is recognized and it is mutually agreed that each method is satisfactory and adequate for obtaining the desired results. The "grab" method is a production method where time is a factor and testing is only to insure uniformity of the delivery. This method lends itself to routine tests for control and the results may be converted into the equivalent "strip" values if desired.

The "strip" method is essentially a laboratory test concerned with the performance of textile materials when stressed. Examples are airplane fabric stretched and doped for airplane wing coverings, and balloon fabric which is rubberized and installed in the envelopes of various types of balloons. There is a definite ratio between the width and the tensile strength of the "strip" specimen. A specimen 0.5 inch wide has half the strength of a one-inch specimen and a two-inch specimen has twice the tensile strength of a one-inch specimen. The same relationship does not hold for "grab" specimens; therefore, the "strip" method does lend itself to calculating the performance of the material as a part of a stressed member, as in the mechanical installations.

(*Continued from page 140.*)

of this associateship at the Bureau, "the work which is being undertaken is divided into cellulosic fibre investigations dealing with cotton and rayon, and protein fibre investigations dealing with silk and wool. The following investigations are now in progress: a study of the acidic and basic properties of silk, wool, and cellulosic fibres; the polyuronides in cellulose and their relation to fibre structure; the effect of oxidizing agents on cellulose; the cell structure of wool; the effect of oxidizing and reducing agents on wool; a study of the reactive groups in silk; the electrophoretic properties of textile fibres, and a microscopic study of the structure of the fibres."

* * *

CASEIN fibre produced by a new method has been patented by Earl O. Whittier and Stephen P. Gould, both associated with U. S. Department of Agriculture, and the patent (No. 2,140,274) is "dedicated to the free use of the people of the United States of America." The patentees claim "(1) As an article of manufacture, a fibre comprising casein and salts of casein and fat acids. (2) As an article of manufacture, a fibre comprising casein and aluminus salts of casein and fat acids." There is no evidence as yet that the patent is workable on a commercial basis, nor that it fails to infringe in any manner the Italian "Lanital" patents. If it has avoided infringement and is commercially workable it will be a valuable gift to the domestic textile industry.

Thin-boiling and Oxidized Starches

By DR. J. R. KATZ *

A Research of U. S. Institute for Textile Research

Thin-boiling Starches Made by Acid

I AM ASKED to describe how thin-boiling starches, especially thin-boiling corn starches, are made, to give a short literature review or a history of their development, and to test and study the properties of one type that is most characteristic of those which are on the market.

For a literature review I would like, first, to draw your attention to the excellent article by Victor Bloede (Baltimore), written in 1928, about the different types of modified starches.[2] It contains a clear description of the types most frequently used in this country, describes their properties, and also contains a long list of patents appertaining thereto. I also want to direct your attention to another very interesting article,[3] this by Jerome Alexander, which contains a long list of patents and much valuable information. Both articles are to be found in R. P. Walton's well-known book.[4]

Many of the facts about thin-boiling starches have been publishd in patents, but patent specifications, as is well known, are not always complete. Moreover, it is not surprising that manufacturers should not be interested in publishing what they do; therefore there is no guarantee that the most important known facts have been published, nor that the published facts are the most important ones, nor even that all the published data are reliable. In view of these probabilities the lack of published data is not surprising. A literature survey failing to give the desired complete and reliable review of the development of acid-made thin-boiling starches, I am privileged to present the following facts, which some starch authorities communicated to me with the permission to publish them:

Originally thin-boiling starch was made by the "drying in" process. Slightly acidulated starch was dried to cubes at a somewhat elevated temperature. A corn starch giving a less viscous paste was produced, but it proved very difficult to control the process exactly, to always get just the desired degree of fluidity. Then Bryer and Duryea[7] developed somewhat similar processes for making thin-boiling corn starches of an exactly determined and easily controllable degree of fluidity, when in paste form. In both cases the starch is mixed with a dilute acid, added to a starch milk and heated at a suitable temperature.

As the most suitable temperature we must accept the highest temperature at which the process can be carried through without any gelatinization of the starch. The high temperature will accelerate the action of the acid, which at room temperature would be much too slow. Any trace of gelatinization must be carefully avoided, as it makes it impossible easily to filter off the starch from the liquid. So, in the case of corn starch a temperature

* The late Dr. Katz was director of the Institute's warp sizing study at Massachusetts Institute of Technology until January, 1936.

around 50° C. (122° F.) will be a desirable one. The acids generally chosen are hydrochloric or sulfuric, the first acting more rapidly than the latter. The temperature is generally well checked so as to keep the process under control.

From time to time a sample is taken out of the batch and its fluidity determined (fluidity is the opposite of viscosity; the higher the fluidity, the lower the viscosity). When the desired degree of fluidity is reached, the acid-starch-water mixture is neutralized and allowed to stand overnight.

The difference between the Breyer and the Duryea processes was chiefly in the concentration of the acid and correspondingly in the time of reaction. A concentrated acid (for instance 1½%) will reach the same degree of fluidity in a much shorter time than a dilute acid (for instance, ¼–½%). Duryea preferred the concentrated acids, Breyer the diluted ones. With diluted acids it is easier to control the process and to get just the fluidity one desires. This has proved to be a great advantage.

Oxidized Starches

There are few subjects in industrial starch chemistry which have been kept as secret as that relating to the manufacture of oxidized starches. We found it difficult to get sufficient information. Either we had grounds to doubt the exactness of the information given, or it was frankly refused. We did not find time, in the short period available, to study the oxidation of starch so that we could judge the commercial products from our own experience, although we began this study. So we had to limit ourselves to the investigation of some typical commercial products.

We investigated two kinds of products: (*a*) thin-boiling sago starches, said to have been made by oxidation, recommended especially for warp sizing of cotton; (*b*) starch gums, said to have been prepared by heavy oxidation of corn starches, and especially recommended for finishing and for paper sizing.

In oxidizing a starch I would keep a starch milk at an exactly constant temperature, adding from time to time a small amount of hypochlorite solution. The oxidation leads every time to a rise of temperature and develops acidity (carboxyl groups being formed). As the pH also has to be kept constant one has to add some weak alkali, like sodium carbonate, which cannot attack the starch granules (any gelatinization would make them difficult to filter off). A small sample slowly attacked by the hypochlorite may be tested with a color indicator, or the pH may be determined with a glass electrode. Adding of a buffer may be necessary to keep the pH in control. Then, when the desired degree of oxidation is reached (almost at constant temperature and constant pH) the starch is filtered off and washed out very thoroughly with water, some antichlor and again with water; then dried in the air at a slightly elevated temperature (no trace of gelatinization allowed).

This prescription can, of course, be changed in a hundred ways, leading technically to very different products. Other oxidants than hypochlorite can be used, etc. The starch may be dried and heated before the antichlor is added. The possible variations are very many.

Those who are sufficiently interested will find it of advantage to study the oxidation of cellulose, the literature of which is voluminous, because the oxidation of starch and of cellulose are analogous in many respects.

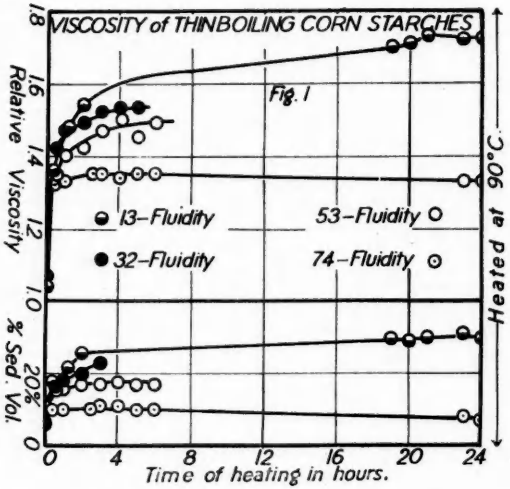
It is on this anology that I constructed my method for oxidizing starch, as just described.

In cellulose it is a well-known fact that oxidation in an acid medium has very different effects than oxidation in an alkaline medium. In an acid medium hydrolysis prevails up to a certain degree; in an alkaline medium oxidation (formation of carboxyl groups, for instance) prevails. The hydrolysis in an acid medium is often very much stronger than the acid alone would give.

The reader may also be referred to the literature reviews in R. P. Walton's book,[1] previously referred to. There he will find also some very interesting older literature on the oxidation of starch.[4] Hydrogen peroxide, for instance, may practically only lead to hydrolysis (almost without oxidation);[5] and a simple reaction is given, allowing us to distinguish, to a certain degree, if the starch has been oxidized in an acid or in an alkaline medium.[6]

The Phenomenon of "Thin-boilingness"

A starch paste of a given concentration has a lower viscosity than one of the same raw starch. As a rule, pastes of thin-boiling starches are slower congealing, when cooled down, than pastes of the same viscosity made of raw starches. Very little is known about this quality of thin-boiling starches, termed "slow congealingness," nor about the explanation of the phenomenon. Our investigation of it has not been completed.



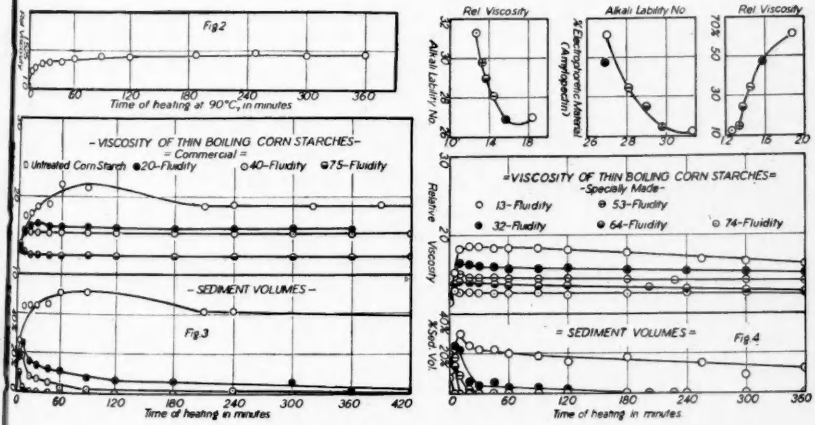
The fact expressed in the term "thin-boilingness" is best seen when testing thin-boiling corn starches with water at 85° to 90° C. In Fig. 1 we show the results of heating at 90° C. a 1% paste of thin-boiling starches

of different fluidities (all made with dilute sulfuric acid from the same corn starch).

One part of starch was mixed with 25 parts of cold water; while shaking slightly 75 parts of water at 90° C. were added, until a very homogeneous thin starch paste was produced. This was heated in a thermostat at exactly 90° C.; a Pyrex glass flask carrying a reflux condenser being used. There was no stirring at all.

From time to time, during 24 hours of heating, a sample was taken with a pipette from the Pyrex flask. It was rapidly cooled down to 25° C., and its viscosity was measured at this temperature in an Ostwald viscometer. There was no stirring during heating.

In the determination of the viscosity we therefore used exactly the same experimental technique as was described in our first report. In this report we are, however, adding a new method of research which proved very simple but very effective. Five cc. of the starch paste are transferred to a 5 cc. graduate and allowed to settle in an ice chest kept usually at 2–3° C. Then, the swollen starch granules will settle, and the volume of this sediment gives us the amount (and degree of swelling) of the swollen granules which have not cooked to pieces. So, as heating goes on, we see that the sediment volume first increases, showing that the degree of swelling increases; in corn starch a maximum of sediment volume is reached (see Figs. 1 and 2).



Harrison showed long ago that the viscosity of starch paste increases with the sediment volume. We have found it extremely useful to determine both sediment volume and viscosity at the same time and to compare both regularly. As a starch paste, the granules of which have cooked to pieces, does not give any sediment volume, the parallel determination of both curves shows us in a very simple way to what degree the change in viscosity is due to the starch granules cooking to pieces and to what degree it is due to other causes.

Fig. 1 shows the curves for thin-boiling starches made especially for us All were heated in a 1% paste, in Pyrex glass, in the manner previously described (without any stirring). The fluidity numbers were determined according to the scales of the Corn Products Refining Co. Fig. 2 shows the sediment volume for 53-fluidity corn starch, and how, on long heating, they reach a constant level (Fig. 1).

As will be seen from Fig. 1 the sediment volume and the viscosity lie the higher, the lower the fluidity number is. This means that, through the acid treatment, the granules have partially lost their power to swell. Why this is so has not yet been cleared up; but we will later discuss several possibilities. At 90° C. these vesicles are very stable; they do not easily cook to pieces. So, the smaller are the vesicles formed through the swelling of the starch granules, the higher is the fluidity number. This is the basic peculiarity of the thin-boiling starches.

Now, if we compare the thin-boiling sago starches (made by oxidation) we find that they behave in many respects in the same way; but the cooking to pieces of the vesicles is (at 80° C.) much more pronounced than in the case of the acid-made corn starches (at 90° C.). We will leave open, for the time being, the question of whether this is due to the oxidation (compared with acid treatment) or to the use of sago instead of corn starch. However this may be we find the following differences, all samples of thin-boiling sago starches being heated at 80° C. (in Pyrex, at the reflux condenser, without stirring): [a]

Fluidity	Maximum of viscosity	Viscosity after 6 hours
non-heated starch	1.91 (after 90 min.)	1.73
25-fluidity	1.88 (after 45 min.)	1.63
50-fluidity	1.74 (after 30 min.)	1.62
90-fluidity	1.23 (after 20 min.)	1.19

Acid-Made Thin-boiling Corn Starches

We examined two series of products: (a) a series of commercial thin-boiling corn starches, all made by the same firm; (b) a series of specially made thin-boiling starches, all made from the same sample of corn starch by one of the firms which was kind enough to make them for us in their laboratories.

Fig. 3 shows the viscosities and sediment values of commercial thin-boiling corn starches, heated without stirring in a 1% paste at 99° C. under a reflux condenser in a bath of boiling water, comparing them with untreated corn starch of the same firm. You will notice how closely the sediment volume curves run parallel with the curves of viscosities observed. In the 75-fluidity starch the granules have cooked entirely to pieces; in the 40-fluidity a small part of them is conserved; even in the 20-fluidity they have lost a good deal of their resistance against cooking.

Fig. 4 shows the viscosity and the sediment volume curves of thin-boiling corn starches especially made for us by one of the starch firms. We want to thank this firm cordially for all the trouble involved and for their liberality in allowing us to publish the following details of the preparation:

[a] One part of starch was mixed with 25 parts of cold water; then 75 parts of water of 80° C. were added.

Analysis of specially prepared thin-boiling corn starches

No.	pH	Fluidity Number	Added acid as H_2SO_4 in making
1	4.5	13	0.06%
2	4.4	32	0.13
3	4.6	53	0.22
4	4.5	64	0.29
5	4.5	72	0.44
6	4.7	74	0.61

The starches were kept (while making thin-boiling starch) at 122° F. in the dilute acid for 24 hours.

The curves for the sediment volumes and for the viscosities are much the same as those of the commercial starches. These small differences, we have found, can be extremely characteristic for a given type of modified starch. We would like to draw the attention of the starch firms to the characteristic nature of these curves (heating without stirring in Pyrex glass under the reflux condenser at 99° C.; viscosity and sediment volume as functions of time).

But, here too we see how much the starch granules have been destroyed (as in the commercial samples) by 6- to 7-hours heating at 99° C. without stirring. It is interesting to compare these data (all samples made from the same sample of starch) with those given in Fig. 1, where the heating was done at 90° C. For 9° C. difference in temperature what an enormous difference in the rate with which the swollen starch granules cook to pieces. This effect, caused by variation in temperature, suggests a chemical reaction for the cooking to pieces of the vesicle walls of the swollen starch granules. It will be remembered from our first report that every starch granule during gelatinization swells up to a vesicle; its wall is made out of swollen amylopectin; its content is a solution of amylose. As the pH of all these starches is acid (approx. 4.5), it is possible that it is an acid hydrolysis which dissolves the vesicle walls (dissolves them the easier the more they have been damaged by the treatment).

You will find in the upper part of Fig. 4 some additional curves, which illustrate further what is characteristic for thin-boiling starches. In the figure at the left the viscosity (expressed as relative viscosity compared with that of water) is connected with the reduction of the starch (expressed as alkali lability, according to Prof. T. Clinton Taylor of Columbia University; an excellent method for determining the reduction, as only the reduction of the starch itself, not of the accompanying glucose or maltose, is determined). We see that the reduction of thin-boiling starches increases with their fluidity, decreases with their viscosity.

The upper figure at the right shows how the amount of amylopectin, separated from the solutions according to the method of M. Samec,[8] decreases with the viscosity (increases with the fluidity). The amylopectin is the viscous material which forms the vesicle walls in starch paste. We, therefore, see that it decreases even after the vesicle walls have cooked to pieces. We find here a new argument for the thesis, announced previously, that in the formation of thin-boiling starches the amylopectin forming the vesicle walls in the starch paste is made more readily hydrolyzed. The amylose seems to be attacked less, because it is a well-known fact that a

concentrated paste of thin-boiling starches "retrogrades" ("reverts") very strongly; so that the amylose seems to have kept its most characteristic quality.

In this country it is chiefly corn starches which are made thin-boiling by dilute acid. However, thin-boiling tapioca, rice, and sweet potato starches are also made by the same process, and even thin-boiling potato starches. The concentration of the acid used has to be varied somewhat according to the type of starch which has to be made thin-boilng.

When starches are acid treated they can easily be made to show a characteristic structure, described in 1934 by E. A. Hanson and J. R. Katz,[9] and in January, 1936, by Otto A. Sjostrom.[10] The two discoveries were made independently and confirm each other excellently. The whole starch granule (after a certain degree of acid hydrolysis) is built up out of regularly ordered units (size 0.3 to 1 micron) which are lying in radial and tangential layers. They probably consist of amylose, while the amylopectin lies between them as a network. In gelatinization this network forms the vesicle wall, while the units dissolve. In this way we understand that, if the amylopectin (the vesicle wall) is mechanically weakened by hydrolysis, it is easily destroyed by stirring and cooking. Figs. 5 and 6 show a wheat

Fig.5

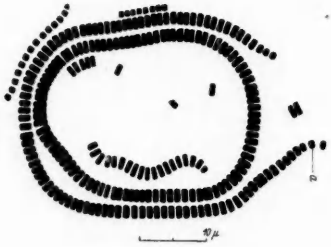


Fig.6

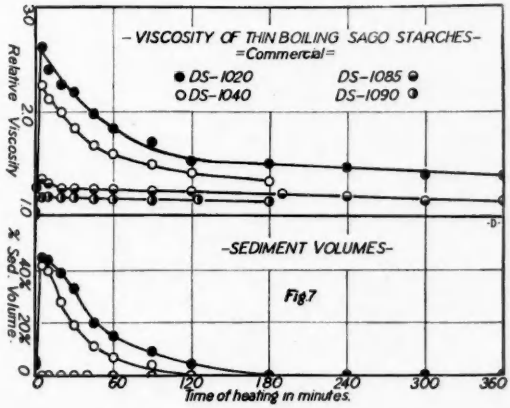
starch granule, acid treated, which has been dissolved into units by swelling in a concentrated solution of a salt (calcium nitrate). Corn starch granules would give pictures of the same kind, but wheat gives more distinct pictures. Fig. 5 shows the beginning of the process, Fig. 6 the end of it. Dr. M. C. Desai has discovered recently a new method for making these units visible, which however he has not yet fully completed for publication.

Why these acid-treated starches swell less at 85°–90° C. is perhaps comparable with H. Staudinger's well-known observation that an artificially synthesized product like polystyrene swells the less the lower its molecular weight, and the more the higher its molecular weight. But a good deal of uncertainty about the explanation prevails.

Thin-boiling Sago Starches, Thinned by Oxidation

One of the starch firms in this country produces a thin-boiling sago starch, especially made for cotton sizing. We had it in two forms: (a) in the commercial form (Fig. 7); (b) in a form made especially for us in their laboratory; all samples of (b) made out of the same sample of sago starch

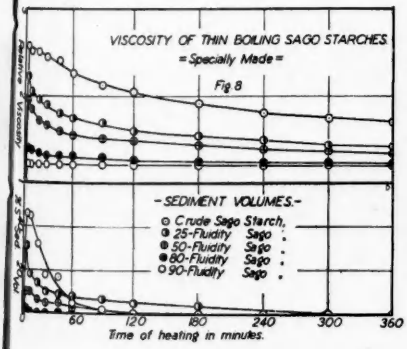
(Fig. 8). Both show the same character. In the way of a root starch the sago lowers its viscosity rapidly when heated without stirring. This is due to the swollen starch vesicles falling to pieces. The more intensively

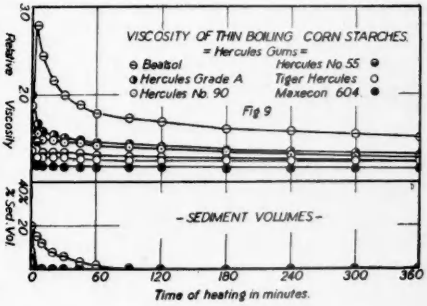


they have been treated by oxidation, the more fluidity the starches show and the easier their vesicles fall to pieces. The higher fluidities (in a 1% solution) soon have lost their entire vesicle structure when heated at 99° C.

Starch Gums (Thinned by Intensive Oxidation)

A commercially well-known corn starch product, existing in six different grades of thinness, was investigated. The character of the viscosity curves,





determined as a function of the time of heating at 99° C. (without stirring), is very characteristically changed. The curves now look almost like those of a potato or other root starch, showing a maximum of viscosity and a

very rapid fall after the maximum has been reached. The vesicles cook to pieces in a very short time, as microscopical examination and sediment volumes show (Fig. 9). The curves in Fig. 9 are typically different from those in Figs. 7 and 8, showing that we have to do with a very different substance.

Is it worthwhile for textile mills to attempt to make the above-mentioned thin boiling acid and oxidized starches? I fear that the difficulties in controlling the processes as exactly as do the starch firms would be too great for a textile mill. The chief merits of these products are due to this exact control. They require the services of a starch chemist. Of course, the mill engaging in such experimenting cannot expect to have the help of the textile adviser of any starch firm.

Instead of attempting such a difficult process, I think that it would be more advisable for the textile mill to use either an enzyme or an oxidant. This also may be too difficult for some slashermen. However, according to reports that I have heard, some mills are satisfied with the results they get.

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9. E. A. Hanson and J. R. Katz. "Experiments About the Grown Structure of the Starch Granule, Made Visible with the Help of Acids." *Z. für physik. Chem., (A)168,* 339 (1934); see also *(A)169,* 135 (1934).

10. Otto A. Sjostrom. "Microscopy of Starches and Their Modifications." *J. Ind. Eng. Chem.,* Jan. 1936, P. 63; this article contains admirable microphotographs; the work was executed in the laboratories of the Corn Products Refining Co.

Committee D-13 Spring Meeting

THE spring meeting of Committee D–13 of the American Society for Testing Materials, will be held March 1 to 3, inclusive, at the Providence-Biltmore Hotel, Providence, R. I. This will be the Silver Jubilee Meeting to celebrate the 25th anniversary of the committee.

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I. Fibres (Synthetic and Natural) and Fibre Analysis

Cellulose Reactions: Mechanism of. H. M. Spurlin. *Trans. Electrochem. Soc.*, 1938, V. 73, 13 pp.; abs. in *C. A.*, 1938, V. 32, Col. 3953. (W)

Cotton Quality: Factors of. A. J. Turner. *Empire Cotton Growing Review*, July 1938; reprinted in *Text. Mfr.*, Aug. 1938, P. 317, 327.

This discussion of various methods of determining cotton quality is summarized by the author as follows: "The hand-and-eye method of examining cotton is not likely to lose its place as the day-to-day method of dealing with the cotton crop on its way from the producer to the user. On the other hand, the tests of fibre properties and the spinning tests have not only become the tests *in excelsis* for assessing new cottons, they have also found a very definite and highly useful niche as supplementary and even crucial tests which many firms use with profit. These physical tests have their proper place as a kind of 'Court of Appeal' while they cannot rival the hand-and-eye method for speed, they alone make it possible to obtain, season after season for any particular growth, objective records which can be duly preserved and which become increasingly useful as they accumulate. It is by means of these and other physical methods that full understanding of the relation between the properties of a cotton and the process of spinning will, it is hoped, ultimately be won." (C)

FLAX CELLULOSE. Alek. Nowakowski. *Polish Agr. Forest Ann.*, 1937, V. 43, P. 90–7 (in German, P. 98); abs. in *C. A.*, 1938, V. 32, Col. 2733.

Using the methods of Doree (*Methods of Cellulose Chemistry, C. A., 27*, 1506), N. analyzed samples of cellulose obtained from flax grown in Poland. Viscosity measurements show that the degree of polymerization of flax cellulose is 1030 and of cotton 1080. Flax is more resistant to wear than cotton. The micelle orientation of flax is 75–80% as compared with cotton which is 55%. (W)

FLAX CELLULOSE: STUDIES ON. J. Dabrowski and L. Marchlewski. *Bull. Intern. Acad. Polon. Sci., Classe. Sci. Math. Nat.*, 1937A, P. 201–16; abs. in *Paper Trade J.*, Aug. 18, 1938, P. 31.

Flax cellulose shows similar chemical properties to cotton cellulose. Hydrolysis to glucose and acetylation to the triacetyl derivatives proceeds alike for both flax and cotton celluloses. The copper number of the acetylcelluloses varies with the mode of formation and is inversely proportional to the viscosity. The absorption of ultraviolet light is continuous and the transparency is not a function of viscosity. Under the action of concentrated acids flax cellulose is converted into a hydrocellulose similar to that obtained from cotton cellulose. Freshly prepared solutions in sodium hydroxide of these products do not show selective absorption of short light waves but prolonged action of sodium hydroxide causes the formation of decomposition products which do absorb the light selectively. (C)

FLAX PRODUCTION: MODERN METHODS—AND MECHANIZATION OF HARVESTING OPERATIONS. *Text. Mfr.*, Aug. 1938, P. 337–8, 344.

The requirements in flax harvesting for quality and yield of fibre, and progress made in mechanical pulling. (C)

(THIS) LANITAL BUSINESS. Lewis Thompson. *Silk J. & Rayon Wld.*, 1938, Aug., P. 15; Sept., P. 22–3.

The properties of the material have been described in many publications on numerous occasions but the present article deals with what is believed to be the most important aspect of the casein fibres—the actual method of separating the casein from milk. (C)

MILKINESS OF VISCOSE RAYON. J. Seiberlich. *Rayon Tex. Mo.*, Aug. 1938, P. 53.

Suggests a test for milkiness and method of removal. (C)

NATURAL WOOL GREASE AND PREPARATIONS MADE FROM IT IN THE WOOLEN TRADE: USE OF. K. Jochum. *Mell. Textilber.* (German Edition), 1938, No. 10, P. 807.(C)

RAYON INDUSTRY: APPLICATION OF OSMOSIS TO THE RECOVERY OF CAUSTIC SODA SOLUTIONS CONTAINING HEMICELLULOSE IN THE. L. E. Lovett. *Rayon Tex. Mo.*, July 1938, P. 42–4; Aug., P. 43–4.

Paper presented at 73d General Meeting of The Electrochemical Society, Savannah, Ga., April 27, 1938. (C)

RAYON TECHNOLOGY: MILESTONES OF. Alexis Sommaripa. *Rayon Tex. Mo.*, July 1938, P. 37–9, 44.

Improvements in physical and chemical properties of rayons since 1907. (C)

RAYON STAPLE FIBRES: HISTORICAL DEVELOPMENT AND PATENTS OF. Edward C. Worden, 2nd. *Rayon Tex. Mo.*, 1938, July, P. 40–1; Aug., P. 41–2, 72.

Concluding instalments of a series of articles on historical development and the patent situation of all rayon staple fibres. (C)

SOLUBILITY OF CELLULOSE IN WATER. J. Strachan. *Nature*, 1938, V. 141, P. 332–3; abs. in *J. Soc. Dyers Col.*, May 1938, P. 241.

Cellulose dissolves in water at the ordinary temperature to the extent of 1.4–2.1 parts per 100,000, giving a clear sol. Dissolution is probably accompanied by some breakdown in the cellulose mol. (C)

XANTHATION OF SODA CELLULOSE: RATE OF. Philip C. Scherer and David W. Miller. *Rayon Tex. Mo.*, 1938, Aug., P. 54–5; Sept., P. 69–71. (C)

II. YARNS AND FABRICS

ACETATE YARN: NEW TYPE. *Rayon Tex. Mo.*, Nov. 1938, P. 31.

Describes a new acetate rayon yarn produced by Tennessee Eastman Corp. The process consists in converting continuous filament acetate rayon filaments in any desired number into a sliver, by breaking and drafting the filaments by a specially developed process based on the "Perlok System." The sliver is then reduced and spun into yarn with normal twist. One of the special features of the yarn is that the length of the individual filaments varies. The long filaments contribute to the tensile strength and the different lengths to the evenness and pliability of the yarn. The broken or otherwise severed filaments do not get an opportunity to tangle and remain parallel during the drafting and spinning but they are not prevented from protruding from the surface of the yarn. The following sizes are commercially available expressed in *worsted* counts: 1/27, 1/40, 1/52 and 1/80. (C)

COLD BEAM TO BEAM SIZER FOR RAYON. *Silk & Rayon*, Dec. 1938, P. 1122, 1146.

A slasher for the warp sizing of viscose, acetate, silk and other materials with cold size and drying without heat was shown in operation at the recent textile machinery exhibition in Manchaster, Eng. The size is called Gammanappe, is dissolved, before use, in a suitable volatile solvent such as benzine, the size being picked up by a blanket which carries it to the warp, impregnation of which is said to be instantaneous and complete. The solvent evaporates during the air-drying, and the sized loom beams are then stored for 48 hours to allow polymerization of the size. It is claimed that desizing by ordinary methods is successful. (C)

COTTON YARN AND CLOTH DYEING AND FINISHING. J. E. Meili. *Canadian Text. J.*, Sept. 16, 1938, P. 32–4.

First instalment of a comprehensive paper on the "Preparation, Dyeing, and Finishing of Vegetable Fibres," delivered at the Summer School of the Canadian Association of Textile Colorists and Chemists. This instalment covers the principles of yarn dyeing and piece goods mercerizing, bleaching, dyeing and printing, with notes on lacquer printing and finishing operations. (C)

CREASE-RESISTING AND WATERPROOFING TEXTILE MATERIALS. A. N. Revresbo. *Text. Recdr.*, Oct. 6, 1938, P. 117.

A review of recent patents. (C)

DRYING OF WOOL. *Wool Rec. & Text. Wld.*, Nov. 10, 1938, P. 33–5, 41.

The author states that it is remarkable, in view of the many times the wool in a piece of cloth may be wetted and dried during its processing, that so little research work has been done to determine the exact influence of drying upon the chemical and physical properties of the fibre. He calls attention to the fact that an exhaustive review of the literature of the subject by Ryberg disclosed only four papers on the subject. This article is a brief summary of the literature, but also includes a number of tests for over-drying, oxidation, etc. (C)

HANDLING STAPLE FIBRE ON THE WORSTED SYSTEM: PROGRESS IN. S. Kershaw. *Rayon Tex. Mo.*, Sept. 1938, P. 89–91. (C)

LOOM PICKING MECHANISMS. Albert Palmer. *Rayon Tex. Mo.*, Nov. 1938, P. 61–4; Dec., P. 68–71, 88.

A review and appraisal of the problems of inserting filling yarn between warp threads in the process of weaving. (C)

MOTH-RESISTANCE OF MOHAIR PILED FABRICS AND WOOLENS IN GENERAL: LARVAE TEST FOR. Charles H. Stiteler. *Am. Dye. Rptr.*, Dec. 12, 1938, P. 729–32.

Experiments are described which have been carried on over a period of two years in an effort to establish an adequate test for mothproofing, and as a possible aid in the development of a much-needed standard for moth-resistance. (C)

NEP COUNT. E. H. Helliwell. *Text. Wld.*, Oct. 1938, P. 52–4.

A quick and simple method that permits check-up of quality of work done by cotton card. (C)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

CAMEL COATINGS. *Wool Record*, 1938, V. 53, P. 753–55, 817–19; abs. in *J. T. I.*, July 1938, P. A409.

A short account is given of the appearance, production and characteristics of the hair fibres (cashmere, camel hair, mohair, alpaca, vicuna, guanaco

and llama). When dyeing mixture fabrics containing hair fibres, level dyeing is obtained by using dyestuffs that may be applied from a strongly acidified bath. Instructions are given for the dyeing of all hair fabrics. For the application of chrome dyestuffs, Goodall's method (*J. T. I.*, 1938, A346) is recommended. (C)

DETERGENT FIELD: RECENT DEVELOPMENTS IN THE. J. B. Crowe. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 690.

Both soaps and synthetics are reviewed. (C)

DISPERSING ACTION OF TEXTILE ASSISTANTS: DETERMINING THE—BY MEANS OF THE CONGO RUBY NUMBER. E. Kessler. *Mell. Textilber.*, German Ed., 1938, No. 10, P. 809–11.

After discussing the various terms of colloid chemistry, the author deals with the references in the literature to the methods of determining the dispersing qualities of textile assistants and gives details of the determination of the Congo Ruby number. Tests were carried out to settle upon suitable conditions for the determination of the Congo Ruby number. It was found for a number of products and it could be shown that the method merely permits of classifying them as good or poor dispersing agents. One single product provides an exception to that rule. It was found upon carrying out tests to determine the Congo Ruby number in the presence of calcium oleate that these numbers were considerably higher than those obtained in the absence of calcium oleate, thereby contradicting the results obtained by *Baudouin*. The present article deals with the conditions that must be maintained during tests of that kind. Upon determining the Congo Ruby numbers with purified products free from salt, it was found possible to determine more accurately the considerable influence of the electrolytes contained in the commercial products. The Congo Ruby number was determined at a temperature of $20.0° \pm 0.1°$ C., because the experiments hitherto described in the literature were carried out at similar temperatures. In actual working practice, however, the products are used at higher temperatures. It is intended to carry out further tests at higher temperatures, because the state of distribution of solutions of dispersing agents is modified and displaced with rising temperature from the colloid disperse state to the molecular or ionic disperse state, a change that probably has a considerable influence upon the dispersing property. (C)

PROCESSING OF SPUN RAYON AND SPUN RAYON MIXTURES. Wm. H. Cady. *Rayon Tex. Mo.*, Nov. 1938, P. 65–8.

Paper presented at 1938 Fall Meeting of A. S. T. M. (C)

RESIN FINISHING OF TEXTILE FABRICS. Donald H. Powers. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 688–89.

A brief treatise on the properties for textile use of the urea formaldehyde and acrylate resins and their principal present uses. (C)

SCREEN PRINTING. A. Franken. *Spinner u. Weber*, 1938, V. 56, No. 21, P. 9–14; abs. in *J. T. I.*, July 1938, P. A410.

A discussion of various practical problems of screen printing such as space requirements, difficulties of drying and the most suitable air tem-

peratures and humidities, the construction, storing and cleaning of stencils, the construction of the printing tables, the preparation of the printing pastes, and steaming, washing and drying processes. A suitable plan for a screen printing works is shown. (C)

SCREEN PRINTING. Ralph D. Green. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 704.

This paper discusses various methods of screen printing including the hand method, the resist or wash out method, the photographic method and the equipment used. (C)

SCREEN PRINTING: DEVELOPMENT. O. Neutwich. *Mell. Textilber.*, German Ed., 1938, V. 19, P. 286–88, 368–70; abs. in *J. T. I.*, July 1938, P. A410.

With the development of roller printing machines and the demand for high production and cheapness, block printing became only of minor importance. The decline in world trade and changes in taste in recent years have, however, led to difficulties in the roller printing industry and resulted in the rapid development of a new hand-printing process, screen printing, which can deal with small orders more economically than roller printing. The advantages of the screen printing process from the point of view of increased employment and the possibility of working with profit in small establishments in different regions in contrast to the concentration of work in large units required for successful operation of the roller printing process are pointed out. Attempts made by the roller printing industry to retard the development of the screen printing industry are discussed and further developments in the latter are predicted. Directions in which further improvements in screen printing processes are required are indicated, and the need for better organization of the industry is pointed out. (C)

SCREEN STENCILS: REMOVAL OF CHROME GELATIN FROM. *Mell. Textilber.*, German Ed., 1938, 372–76; abs. in *J. T. I.*, July 1938, P. A410. (C)

SILK PRINTING SCREENS: APPLICATION. *Silk J. Rayon Wld.*, 1938, V. 14, No. 164, P. 49–51; No. 165, P. 43–45; No. 167, P. 31; abs. in *J. T. I.*, July 1938, P. A410. (C)

SILK AND SILK PROCESSING: RECENT DEVELOPMENTS IN CHEMISTRY OF. Walter M. Scott. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 710–16.

This article is the fifth in a series of reviews which have appeared in this journal under the same title. These reviews summarize the progress which has been made in connection with the fundamental chemistry of raw silk and the chemical processes which play a part in the transformation of the raw silk into the finished product. The previous articles have reviewed the developments prior to November of the year 1937. The present review brings the story up to November, 1938. For purposes of clarity the subject is divided into four chapters as follows: (1) Chemistry of Raw Silk, (2) Preparation of Silk, (3) Dyeing and Finishing of Silk, (4) Processing of Silk Hosiery. (C)

SODIUM ALGINATE AS A PRINT THICKENING PASTE. P. H. Cate. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 716–21. (C)

SURFACE-ACTIVE CHEMICALS. George A. Thomas. *Text. Wld.*, 1938, Aug., P. 48–9; Sept., P. 80–1; Oct., P. 60–1; Nov., P. 72–3; Dec., P. 66–7.

Methods for determining wetting-out and detergent properties of various types of compounds, and procedure for determining their suitability for specific textile applications are described and charted for easy reference. (C)

SYNTHETIC RESINS IN THE FINISHING OF RAYON STAPLE, YARN AND FABRICS. J. Wakelin. Rayon Tex. Mo., 1938, Sept., P. 105–6; Oct., P. 67–8. (C)

TEXTILE PROCESSING IN GREAT BRITAIN: REVIEW OF DEVELOPMENTS DURING 1938. A. J. Hall. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 708–9. (C)

WOOL DYEING: EFFECT OF METALS IN. "Indigo." *Text. Recdr.*, Sept. 6, 1938, P. 42–3.

The author discusses the various metals used in dyeing machines and their effects on the dyed materials. (C)

WOOLEN GOODS: "DRISOL" "UNSHRINKABLE" TREATMENT. *M/cr. Gdn. Comml.*, 1938, V. 36, P. 422; abs. in *J. T. I.*, July 1938, P. A412.

A general review of the progress of the "Drisol" process for rendering wool unshrinkable by treatment with a solution of sulphuryl chloride in white spirit. Most acid wool dyes are fast under the treatment but the goods (e.g., socks) may be dyed level after the process. Viscose and acetate rayons are not affected by the process but cuprammonium rayon is slightly weakened. Raw silk is not affected but degummed silk is strengthened. It is said that the shrinkage behavior of mixed fabrics may be worse than that of all-wool so that the possibility of applying the Drisol process to mixtures is an important advantage. (C)

IV. RESEARCH METHODS AND APPARATUS

ACIDITY AND ALKALINITY IN FABRICS BY MEANS OF A MICRO GLASS ELECTRODE. E. A. Goode and A. B. Cox. *Soc. Chem. Ind. Proc.*, 1937, V. 37, P. 1215–9; abs. in *C. A.*, 1938, V. 32, Col. 1938. (W)

ASH PICTURES: IDENTIFICATION OF FIBRES AND TEXTILES. K. Czapla. *Blätter Untersuch. u. Forschungs-Instrumente*, 1937, V. 11, P. 59–63; abs. in *C. A.*, 1938, V. 32, Col. 2360.

The method is based on the development of an artificial ash skeleton of the fibre to be detd., identified by impregnation with solns. of 16 parts of thorium nitrate and 0.4 parts of cerium nitrate in 100 parts of water. Fibres may be impregnated immediately after washing, while textiles first have to be freed from the finishing agents and fat. Then, the samples are ashed on a platinum sheet with a micro burner and imbedded into balsam and xylene, giving typical ash pictures. In this way, all kinds of plant fibres, silks and rayons (except acetate rayon and wools) can be identified. (W)

BLEACHING QUALITY OF BAST FIBRES: DETERMINATION OF. E. Kayser. *Mell. Textilber.* (German Edition), 1938, No. 9, P. 725. (C)

CLEANNESS OF SCOURED WOOL. *Wool Rec. & Text. Wld.*, Aug. 25, 1938, P. 437–8, 443–5.

Methods of evaluating the efficiency of the scouring process are discussed, first in connection with scoured raw wool and dry-combed tops, and also in connection with tops combed in oils. An effective method of determining oxidation is suggested. (C)

COTTON FIBRE MATURITY. POLARIZED LIGHT AND CROSS-SECTION STUDIES. E. R. Schwarz and L. Shapiro. *Rayon Tex. Mo.*, 1938, June, P. 59–61; July, P. 53–5; Aug., P. 56–8; Sept., P. 108–9.

Describes a counting device for study of maturity of cotton fibres under polarized light and treatment of the resultant data; also the preparation of fibre sections. (C)

EXAMINATION OF THE PRINCIPLES OF ORTHOSTEREOSCOPIC PHOTOMICROGRAPHY AND SOME APPLICATIONS. L. C. Martin and T. R. Wilkins. *J. Opt. Soc. Amer.*, Oct., 1937, P. 340–9; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

A method of orthostereoscopic photomicrography has been developed primarily for the purpose of the measurement of the relative spatial angles of α-ray tracks in photographic emulsions. The conditions for obtaining the requisite perspectives from photographs made with a compound microscope system, and the necessary relations between the positions of an internal stop in the microscope, the shift of the object on the stage, and the mounting of the perspectives in a special form of Wheatstone stereoscope are discussed. A number of trial measurements with dry lenses and immersion microscope systems with magnifications ranging from 100 × to 970 × illustrate the application of the theory. The methods are applicable to other objects. (S)

FLUORESCENCE OF COLORANTS FOR RAYON ACETATE. M. Déribéré. *Rusta-Rayonne*, 1937, V. 12, P. 363; abs. in *C. A.*, 1938, V. 32, Col. 2357.

A list is provided, using Wood's light. It is interesting to note that blacks are not fluorescent. Fluorescency, generally, is a function of the height of tone, and shows a max. of luminescence corresponding to purity concns., say 1 to 2%, according to the specimens. Accordingly, one should always seek the max luminosity effect. (W)

"FLUORESCENCE OF LIGHT FILTERS": REMARKS ON THE. *Atelier*, Jan., 1938, P. 20. (See *Ibid.*, No. 44, P. 210, 1937); abs. in *Eastman Kodak Abs. Bull.*, June 1938.

Fluorescence may arise not only from the filters but also from the Canada balsam in the lens itself, especially if the first elements are of crown glass which is transparent to the ultraviolet. A filter which shuts out the ultraviolet is suggested for all mountain photography. (S)

MEASUREMENTS WITH THERMOELEMENTS AND RESISTANCE THERMOMETERS IN TEXTILE PLANTS AND IN THE EXAMINATION OF TEXTILES. Adolph Rossie. *Monatsh. Seide Kunstseide*, 1938, V. 43, P. 3–6, 41–6, 87–92; abs. in *C. A.*, 1938, V. 32, Col. 3621.

A detailed review covering practical devices, measurement of the temp. of air, gases, surfaces and of fabrics (or wood, gelatin and insulations),

detn. of heat transfer in dependence on air movements, heat cond. and heat passage, and b. p. and f. p. (W)

MICROGRAPHIC MOVIE MACHINE. J. Maurer. *Movie Makers*, March 1938, P. 126–7, 138–9; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

A description is given with illustrations of a simple home-made outfit for motion photomicrography with a 16-mm. or 8-mm. camera. The camera is suspended on a bracket from a vertical board above a vertical microscope. The camera lens is focussed at infinity. The microscope image is focussed through a telescope with the aid of a cover glass beam-splitter. (S)

MICROSCOPICAL EXAMINATION OF FIBRES. *Umschau in Wiss. und Tech.*, 1938, P. 42; P. 217–8; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

In order to study the surface structure of fibres under the microscope, the author immersed the lower half of the fibre in a liquid having the same index of refraction. By this method the details of the lower half became invisible. (S)

MONOCHROMATOR, NEW. Y. Öhman. *Nature*, Jan. 22, 1938, P. 157–8; abs. in *Eastamn Kodak Abs. Bull.*, June 1938.

The monochromator consists of several sets of quartz plates and Polaroid filters with which is applied the principle used by R. W. Wood for separating the D-lines of sodium. Using four quartz plates, the thickness of which increases in a geometrical proportion, it is possible to separate a band of 50 A. By tilting the filter, the position of the band can be altered, although this procedure produces satellite bands. (S)

PHOTOMICROGRAPHY FOR EVERYONE. H. C. McKay. *Amer. Phot.*, Nov. 1937, P. 786–92; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

Excellent photomicrographs can be made with an inexpensive microscope and a Brownie camera without a lens. The effect of chromatic aberrations of the lens may be reduced by using panchromatic film and a deep-cutting green filter. (S)

PHYSICAL AND CHEMICAL TEXTILE TESTING. John H. Skinkle. IX, PART II. CHEMICAL TESTING. Introduction and General Considerations. *Am. Dye. Rptr.*, July 25, 1938, P. 412, 422–7. X, PART II. CHEMICAL TESTING. Organic Extraneous Matter. *Ibid.*, Aug. 22, 1938, 462, 471–6. (C)

SOFT X-RAYS: INVESTIGATIONS WITH. S. Löwe-Beer. *Fortschr. Geb. Röntgenstr.*, April 1938, P. 394; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

A brief account is given of experimental soft x-ray photography of specimens of skin, the organs of a frog, flowers, etc. (S)

STEREOSCOPIC DRAWING. John T. Rule. *J. Opt. Soc. Am.*, 1938, Vol. 28, P. 313–22.

The present paper develops a system of drawing stereographs based primarily on convergance principles. It is pointed out that the draftsman

should constantly remember that once such a system has been devised his task has only begun, for the formation and interpretation of stereoscopic images are not reducible to a completely rigid, mathematical system. Many of the details that lead to confusion or erroneous interpretation have been pointed out and methods devised for avoiding them. The use of the stereograph in connection with textile research is an obvious extension from the stereophotomicrograph and other photographic work which appears with increasing frequency in the literature. (S)

STUDENT MICROPROJECTOR. G. Snider, C. Taylor, and V. Heines. *J. Chem. Education*, Jan. 1938, P. 16–7; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

A microprojector as a student project may be assembled with ease. The materials necessary for this set-up are: (1) a strong light source, (2) two biconvex lenses, and (3) any standard microscope. All four parts must be as close together as possible to eliminate light leakage. A large square of cardboard or lead foil serves as a screen. The intense beam of light passing through the two condensing lenses should be a spot of maximum brightness on the focussing objective of the microscope. The images may be thrown on a white wall or a daylight projection screen. Best results are obtained in a darkened room. Slides made by the students of the science classes afford entertainment and instruction for programs. (S)

TESTING DYESTUFFS WITH THE PHOTOMETER. C. H. S. Tupholme. *Text. Col.*, June 1938, P. 379–80. (C)

TESTING THROWN SILK. L. A. Burns. *Tex. Wld.*, July 1938, P. 57.

As a result of experimental work the author states that the extraction method appears to give more accurate results than the boil-off, and presents and explains comparative data. (C)

ULTRAVIOLET FLUORESCENCE IN FIBRE ANALYSIS: IMPORTANCE OF. Hans J. Henk. *Kunstseide u. Zellwolle*, 1937, V. 19, P. 426–7; abs. in *C. A.*, 1938, V. 32, Col. 3620. (W)

ULTRAVIOLET RAYS IN FLUORESCENCE ANALYSIS: USE OF. J. Grant. *Mfg. Chem.*, Dec. 1937, P. 387–92; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

The author gives a general discussion of fluorescence analysis, including the methods of production of ultraviolet light, the experimental technique for detection of the fluorescent light, and examples of the applications of the method in examination of pigments, solvents, oils, plasticizers, printing inks, and other industrial materials. (S)

VAT COLORS FIXED ON FIBRES: IDENTIFICATION OF. G. Buzzi-Ferrario. *Tiba*, 1937, V. 15, P. 411, 539, 601–9; abs. in *C. A.*, 1938, V. 32, Col. 2357.

Tables are shown, giving the alterations or identifications on groups of dyes, of the IG and Ciba companies, possessing rating fastness of I and P, resp., which have resulted from treatment with alk. and acid hydrosulfite, H_2SO_3, HNO_2, $SnCl_2$, benzene and pyridine. (W)

WATER IMPERVIOUSNESS OF IMPREGNATED FABRICS: TESTS FOR. Bedu. *Klepzig's Textil-Z.*, 1938, V. 41, P. 99; abs. in *C. A.*, 1938, V. 32, Col. 3622.

A review and description of the bag, water-pressure, water-drop and irrigation methods. (W)

WOOL AND COTTON: DETECTION OF SPONTANEOUS DETERIORATION OF. Rinoldi. *Boll. laniera*, 1935, V. 49, P. 185–8; abs. in *C. A.*, 1938, V. 32, Col. 2756.

Incipient degradation of wool is best detected by the Pauly-Beeke process. When cotton is boiled for 5 min. with 3% NaOH, the presence of oxy- or hydrocellulose is indicated by a yellow coloration. Immersion for 10 min. in dil. Nessler's reagent gives a yellow coloration with oxycellulose. In freshly-prepared ammoniacal $AgNO_3$ oxy- and hydrocellulose give a yellowish-brown coloration within 10 min., whereas unaltered cellulose remains colorless for 1 hr. (W)

WOOL: NEW METHOD OF DETECTING INJURY TO. E. Elöd and H. Reutter. *Mell. Textilber.*, 1938, V. 19, P. 67–72; abs. in *J. Soc. Dyers Col.*, May 1938, P. 247.

With the aid of the method developed by Elöd and Haas, even quite slight injury to wool fibres can be determined from the rate of absorption of certain acid dyes, *e.g.*, Crystal Ponceau 6R, under definite conditions, *viz.*, by dyeing for 10 min. at pH 1.3 approx. and 70° C. Treatment of wool with concentrated ammonia, until it is disintegrated, does not affect the dyeing properties of the particles, but increases the rate of dyeing. The swelling of wool also only affects the rate of dyeing. (C)

V. ECONOMICS AND MISCELLANY

ADSORBABILITY OF CHAIN MOLECULES. A. Baum and E. Broda. *Trans. Faraday Soc.*, July 1938, P. 797–99.

The adsorbability generally grows with increasing chain-length of the molecules of the adsorptive, even if the adsorption heat is not considerable. The smaller adsorption velocity of long chain compounds, however, may cancel the effect of their greater adsorbability in equilibrium. (X)

BACTERIAL CONTAMINATION OF THE AIR OF TEXTILE MILLS, WITH SPECIAL REFERENCE TO THE INFLUENCE OF ARTIFICIAL HUMIDIFICATION. W. F. Wells and E. C. Riley. *J. Ind. Hyg. Toxicol.*, 1937, V. 19, P. 513–61; abs. in *C. A.*, 1938, V. 32, Col. 2758.

Positive evidence has been established that humidification with sewage-polluted water subjects the occupants of the room to breathing air in which organisms discarded from the human body are suspended. (W)

COLORS AND COLOR MEASUREMENT: ATTRIBUTES OF. W. Ostwald. *Preuss. Akad. Wiss. Berlin, Ber.*, 1937, P. 402–36.

A presentation of the author's views on the classification and measurement of color, together with criticism of the trichromatic system. (X)

COLOR MEASUREMENT: PARTICULAR APPLICATION OF THE LUTHER CONDITION TO. M. Richter. *Z. wiss. Phot.*, 1938, P. 36–41; abs. in *Eastman Kodak Abs. Bull.*, July 1938.

In Luther's brightness method of color measurement, a photometric comparison of the sample with a white surface is made, using three suitably selected filters over the eyepiece of the photometer. The filters are designed to convert the luminosity curve into each of the three color mixture curves, so that the three readings of brightness through these three filters are automatically the tristimulus values of the color. The difficulties with this method are twofold: (1) The filters required are not easily secured. (2) The colors of the sample and the white comparison field are rarely the same, even when viewed through the filters which introduces all the uncertainties of heterochromatic photometry. Schmidt (M. Schmidt: "Ein verbessertes Farbenmessverfahren," Dissertation, Dresden, 1935) suggested the use of more than three filters, each having a sufficiently narrow transmission band so that all important color differences are eliminated from the photometric observations. The readings must then be combined arithmetically to give the desired tristimulus values. The Luther condition for the selection of filters was extended to this case by Schmidt, whose work was further extended by Richter to allow for the choice of basic stimuli other than those recommended by the International Commission on Illumination. The normal equations which are commonly encountered in statistical discussions are applied to the problem of selection of filters for use in this brightness method of color measurement. (S)

COLOR THEORY AND COLOR MEASUREMENT: REPORT ON. H. Schober. *Physikal. Z.*, No. 38: P. 514–55, No. 13/14, 1937; abs. in *Eastman Kodak Abs. Bull.*, June 1938.

The present status of physical-physiological color theory is reviewed. The rivalry between the Young-Helmholtz and the Hering theories is described. The Young-Helmholtz theory is said to be more convenient for the explanation of the laws of color mixture, and the Hering theory is regarded as being more consistent with the physiological phenomena of color contrast, color induction, and the facts of color vision. The unique situation of colorimetry among the branches of physics, as the most firmly established science which has attempted to bridge the gaps between physics, physiology, and psychology, is emphasized. Recommendations are made for a standardization of the German terminology, and the standard conditions for observation are specified. The visual purple theory of color vision proposed by Weigert, on the basis of his experiments with the photodichroic properties of visual purple, is discussed in greater detail than in any other accessible publication, and the arguments in support of this theory are fully outlined. The relationships between the various parameters in which colors have been specified by various authors are correlated, and the several methods of direct, indirect, and objective colorimetry which have been used or suggested in the past are described and compared. (S)

LINEAR ADSORPTION ON TWO-DIMENSIONAL COLLOIDS. P. F. Pochil, T. I. Silberman and D. L. Talmud. *Acta. Physicochim.*, 1938, P. 517–36.

In English.—The monolayer of two-dimensional barium myristate colloid, previously studied by the authors, was used as adsorbent for the quantitative measurement of linear adsorption. Dimethyl ester of tetrade-

cane dicarbonic acid was used as linearly active substance, its surface concentration ensuring the gaseous state of the ester monolayer. The number of linearly adsorbed molecules of ester on the particles of the two-dimensional colloid was experimentally determined. The size of the particles of two-dimensional colloid, calculated from the curve of linear adsorption, has been shown to coincide with the value obtained from the curve of the kinetics of formation of two-dimensional colloid. (X)

PSYCHO-MEDICAL METHODS IN SELECTING PERSONNEL IN THE TEXTILE INDUSTRY. G. A. Roemer. *Mell. Textilber.* (German Edition), 1938, No. 9, P. 765.

It is pointed out that pure psychotechnics have not been able to furnish perfectly accurate information about the capabilities of a human being, for which reason the author has developed the psychomedical method which unites the accuracy of experimental psychology with psychoanalytical depth on a medical basis. A number of diagrams are given to show how the automatic apparatus designed by the author records a pneumogram which discloses the psychical condition of the person being tested, his temperament, and his reaction to difficulties that occur during work. (C)

STARCH PASTES: EFFECT OF ACID MODIFICATION ON PROPERTIES. W. Gallay and A. C. Bell. *Canadian J. Rsch.*, 1936, V. 14, P. B383–90; abs. in *J. T. I.*, May 1937, P. A287.

Several series of modified potato starches covering a wide range of fluidities were prepared by treatment with dilute hydrochloric acid at 50° C. As in the case of previous results obtained with corn starches it is shown that the viscosity is dependent on the rate of shear and that the data are well expressed by the exponential relation $F = KP^n$, where F is the flow, P is the pressure, K and n are constants. The value of n decreases rapidly with increasing degree of modification. It is shown that n depends on the volume occupied by the swollen granules in the paste, and that n is much greater in potato starch pastes than in corn starch pastes owing to the greater swelling of the granules. This swelling decreases with increased degree of modification. The stability of the granules in alkaline pastes is described for both potato and corn starches, and the fluidities of alkaline potato starch pastes are shown to be much greater than those of corn starch pastes of comparable extent of modification. The gelatinization temperature rises with increasing modification. At the same time the power of hydration of the granules decreases and they appear to become denser and more compact. The resistance to mechanical injury becomes greater with increasing modification, and the injured granules swell to a less extent. The decreased hydration (hydration plus immobilization) leads to different forms of breakage when the granules are crushed. Prolonged heating of starch pastes causes a rapid decrease in the value of n, owing chiefly to a disruption of the granules with consequent change in the phase-volume ratio. (C)

STARCH PASTE AND SOLUTION: VISCOSITY. M. Bline and M. M. Samec. *C. r. Congr. Int. Techn. Chim., Schéveningue*, 1937, V. 5, No. 2, P. 214–49 (through *Chem. Zentr.*, 1938, i, P. 1016); abs. in *J. T. I.*, June 1938, P. A375.

A critical review of methods and apparatus. (C)